A DESIGN PROCESS FOR FORCENET EXPERIMENTATION

By Brad Poeltler and Dr. Shelley P. Gallup

FORCEnet is the core of Sea Power 21 and Naval Transformation, and it is the Navy and Marine Corps vehicle to make the CNO's vision of network-centric operations/warfare an operational reality. FORCEnet is the command and control pillar that gives speed and agility to the commander. The commander can then optimally employ Sea Strike, Sea Shield and Sea Basing by integrating weapons, sensors, reachback centers and warfighters at all levels into a secure networked, distributed combat force — the Naval contribution to the Global Information Grid (GIG).

Navy leadership must have accurate and timely data to make well-informed decisions about future FORCEnet capabilities. The Naval Network Warfare Command (NETWARCOM), the operational agent for FORCEnet, has created a series of annual events to supply these data points. These events are collectively called Trident Warrior (TW).

"What makes Trident Warrior different from other naval assessment events is the level of detail of the analysis data. That level of detail can be attributed to the Trident Warrior process," says Capt. Chris Abbott, director of FORCEnet Innovation and Experimentation. "The strict compliance to this process is what ensures event consistency and allows us to maintain a high standard in our FORCEnet assessments."

A 13-step process was established to produce the experimentation objectives, experiment design, planning requirements and assessment needs, shown in Figure 1. This process was not simply invented from scratch. It evolved from experience with former Fleet Battle Experiments, from the Modular Command and Control Evaluations System (MCES) and from the Code of Best Practices in Experimentation (COBPE), produced by the Command and Control Research Program (CCRP).

This process may look fairly routine by most research standards, but what makes it unique is the in-depth development of the objectives (step 5), the detailed models that are developed for each objective (step 6), and the computer-based, enterprise environment designed for Trident Warrior planning and execution, the FORCEnet Innovation and Research Enterprise (FIRE).

As mentioned, the TW process begins as any large event with planning team development, concept design, target technology/procedural selection and asset identification. But beginning with step 5, objective development, TWs begin to differ. "This step is critical to the success or failure of the event," says Cmdr. Tony Parrillo, director of TW05. "Each critical question that is identified as a FORCEnet issue is developed as a TW objective with the final assessment always in focus. That is what we call the 'so what' element of Trident Warriors. If it does not meet the so what test, that is, answer a major FORCEnet question, we drop that objective and move on."

Figure 1. Trident Warrior Process

Phase	1	2	3	4	5	6
Due Dates	Pre-CDC	CDC	Pre-IPC	Pre-IPC	Pre-MPC	Pre-MPC
Step	Establish Team	Concept Development	Technology/TTP Harvest	Asset Identification	Develop Experiment Objectives	IDEF/OSD/Process Action Maps
Required Product	Defines Names and R/R	Defines Experiment Scope and Focus Areas - Insure aligns with Naval Vision	Defines and Researches selected Tech and TTPs	Platforms Ded and Install Scheduled	Defines the *So What* and how to measure	Turns the words into design diagrams

Phase	7	8	9	10	11	12	13
Due Dates	Pre-MPC	Pre-FPC	Pre-FPC	TBD	TBD	TBD	TBD
Step	Experiment Design	Event Definition	Data Collection Plan	Execution	Final Report	Assessment OAA	MUA
Required Product	Lays out the flow and applicable scenarios to meet objectives	Defines the detailed execution plan	Maps the data to be collected to the means	Insure plan is flexible to changing environment	Must be quick and good	Necks down analysis to assessment	Necks down assessment to DOTMLPF recommendations

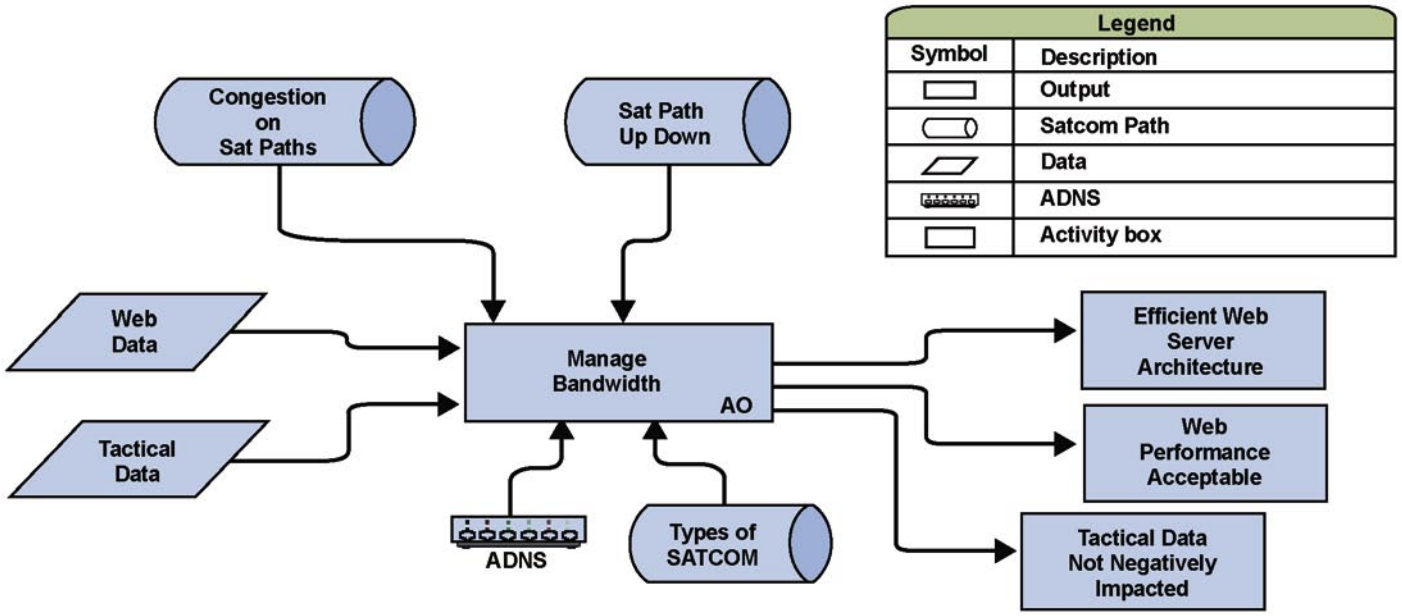

Figure 2.

TW objectives are broken down into exceptional detail by decomposing each into the following eight categories: (1) objective statement (a high-level description of what the objective is intended to produce); (2) FORCEnet questions to be answered; (3) the information goal (intent of the assessment); (4) operational conditions required to produce valid data relevant to the question being asked; (5) systems conditions required; (6) information conditions required; (7) measures and metrics that will be collected and; (8) the data required to produce the assessment which meets the objective statement. This step can take several months to complete because a typical TW can generate up to 150 separate objectives. But when these questions are correctly focused at the right level of detail the rest of the event design is optimized.

Once the objectives are identified then the TW planners begin step 6 – construction of models. For each of the objectives, a model is produced, beginning with a generalized model using Integrated Definition 0 (IDEF0) as a basis, shown in Figure 2. This is followed typically by an Operational Sequence Development model. This work has obvious purposes, such as identifying requirements that drive planning. But another purpose is to produce common descriptions for each objective that are then used for collaboration across all TW objectives. This process produces a much higher integration of experiment design and supports the "system and system-of-systems" view that is at the core of FORCEnet.

Modeling, common to systems analysis and systems engineering, is designed with the final assessment in mind, and it can incorporate emerging planning requirements. This focus helps identify the critical points for training, event design and data collection. Figure 2 shows TW04 diagrams for the FORCEnet bandwidth management objective.

The IDEF model uses a standard syntax and set of simple rules in which a verb phrase in the central box describes what is to be achieved. Inputs enter the left side of the box, controls enter from the top, resources from the bottom and output to the right. At the highest level, each IDEF0 models the requirements for an objective.

From the initial IDEF0 model, a more complete description of the system components and their relationships to each other can be combined in an Office of the Secretary of Defense (OSD) view, such as the one shown in Figure 3. This view does not replace other architecture, engineering and systems views common to systems engineering; however, as a high level description of the system, it is invaluable to further planning and experiment design.

These two modeling diagrams become the principal visual reference used in the remaining TW planning steps including event design and development of the data collection plan. Another benefit of this TW step is that many of the objectives developed for a TW are cognitive in nature rather than technical. These diagrams when applied to human system interface (HSI) questions provide insight into refinement of tactics, techniques and procedures (TTP) data collection and assessment requirements.

The final unique feature of the TW process is the FORCEnet Innovation and Research Enterprise (FIRE). FIRE was developed out of the need for structured data collection, data reconstruction for analysis and generation of TW analysis reports. No such system previously existed, and the Naval Postgraduate School (NPS), the analysis lead for TW, was asked to examine different approaches. NPS developed FIRE as an enterprise computing solution, based on Oracle 9i and Oracle 10g technology, with unique artificial intelligence (AI) applications included in the design.

Final results from TW reports are connected to FORCEnet concepts, experiment objectives and modeling diagrams down to the data. In the past, constructing this design was exceedingly time consuming and manpower intensive. But FIRE makes this process quick and easy.

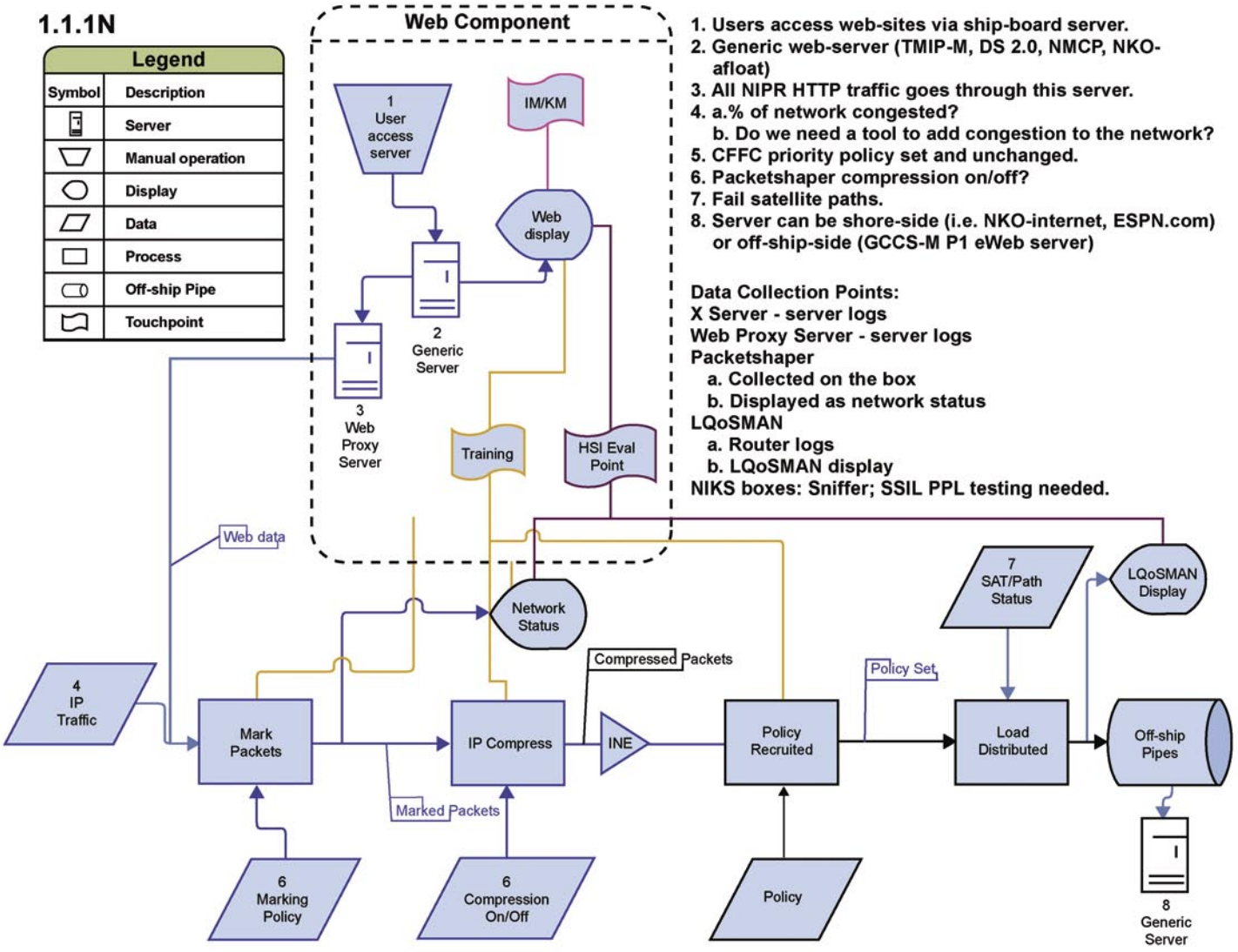

Figure 3.

TW planning is greatly dependent on collaboration among a wide range of experts, military, government and contractor personnel, who all need to access data. FIRE uses artificial intelligence tools to search across a broad set of information, for example, lengthy documents and chat files, where planners are trying to pull specific data that typically take a long time to manually search. Fuzzy logic tools are used to gather the best approximation of the required data from the document.

Although requirements may seem unduly strict, this degree of rigor results in a level of detail that is necessary for making critical FORCEnet decisions. Several of the recommendations resulting from earlier TW exercises have resulted in major modifications to ship installation schedules and future FORCEnet capability procurements.

"I have come to rely on Trident Warrior information and assessments," says Vice Adm. James McArthur, commander, NETWARCOM.

Furthermore, the Chief of Naval Operations Future Requirements Division (N7) has begun to utilize Trident Warrior as a primary means for field testing Naval Capabilities Development Plan (NCDP) issues prior to critical Program Objective Memorandum (POM) decisions.

Trident Warrior 05 is currently being planned for a November/December 2005 execution utilizing the Iwo Jima (LHD 7) Expeditionary Strike Group in the Virginia Capes Operating Area (VACAPES). The FORCEnet analysis objectives range from operational level command and control decision aids to coalition network design.

A detailed article describing TW05 will appear in the next edition of *CHIPS*.

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